Fast action, team coordination critical when surgical fires occur

New information on surgical fires sheds light on risk factors, patterns of injury, and why OR teams need to plan for their occurrence.

A May 2013 study led by Karen B. Domino, MD, MPH, is the first to assess closed malpractice cases of surgical fires. Dr Domino, professor of anesthesiology and pain medicine and adjunct professor of neurological surgery at the University of Washington, Seattle, and colleagues analyzed 103 OR fire claims in the American Society of Anesthesiologists (ASA) Closed Claims Database from 1985 to 2009.

Most claims involved patients who had monitored anesthesia care (MAC) with open oxygen delivery for upper chest, neck, and head procedures. Electrosurgical instruments were responsible for fires in 90% of claims.

Recognition of the fire triad (oxidizer, fuel, and ignition source), particularly the role of supplemental oxygen by an open delivery system during use of electrosurgical instruments, is key to prevent OR fires, says Dr Domino. Prevention is important because fires occur so quickly in the presence of oxygen, she says.

A December 2012 report from the Pennsylvania Patient Safety Authority analyzed 70 reports of OR fires submitted to its database from July 1, 2004, to June 30, 2011.

The fires occurred on the surgical field or in the patient’s airway.

Of 65 reports with information about the ignition source, an electrosurgical unit was the source in 58%, a fiberoptic light cord in 38%, and a laser in 3%.

The role of oxygen was highlighted in 7 reports, with 2 specific mentions of nasal cannulas, 1 “leak” in the oxygen tubing, 1 oxygen mask over a tracheostomy stoma, and 1 using an electrosurgical instrument to incise a trachea during a tracheostomy.

The data shows a slight downward trend in the number of fires—ranging from 1 per 157,545 procedures from 2007 to 2008 to 1 per 309,305 procedures from 2010 to 2011—but there is still a need for vigilance, says Mark Bruley, CCE, vice president, accident and forensic investigation at ECRI Institute, coauthor of the report.

Role of MAC, oxygen

In her study, Dr Domino found that malpractice claims related to electrosurgical-ignited fires during MAC increased from 6% of such claims between 1985 and 1989 to almost one-third of claims related to MAC between 2000 and 2009.

“We are seeing more fires in MAC cases in recent years because we are doing more MAC cases,” she explained. MAC has become a lot more popular, especially in the ambulatory setting, because patients have less nausea and vomiting and are less sedated; thus, they can be discharged more quickly.

A contributing factor is that many MAC patients are given propofol, which can result in more respiratory depression more quickly, so anesthesia providers put oxygen on these patients—whether they need it or not—just out of fear they might desaturate, she says.

Anesthesia personnel also give more oxygen now than in the past, says Dr Domino, because of pulse oximetry. “They are more cognizant of the oxygen saturation, and they give more oxygen,” she says.

According to the ASA Task Force on Operating Room Fires and the Anesthesia Patient Safety Foundation, the most important practice for managing fire risk is to deter-
mine if supplemental oxygen is needed during the procedure. This is especially important when oxygen is administered via a nasal cannula or face mask, which would saturate the surgical field with high oxygen concentrations.

To reduce risk, keep oxygen concentrations at less than 30% because there is less combustion at this level, says Dr Domino.

Risk can be reduced further by using open draping techniques to prevent accumulation of oxygen under the drapes.

When there is a risk of fire and the patient requires oxygen, anesthesia personnel should consider a general anesthetic with an endotracheal tube or laryngeal mask, rather than expose the patient to a heightened risk, Dr Domino says.

Other recommendations include not using regular monopolar electrosurgical instruments, if possible, in high-risk situations. If used, the power settings should be as low as possible, consistent with clinical needs, says Bruley. Instead, consider using bipolar electrosurgical instruments, if they will meet the needs of the procedure, he says.

**Coordinated approach**

The Pennsylvania Patient Safety Authority says a coordinated approach to surgical fire prevention and response by the surgical team is important to eliminate fire hazards and to minimize the time needed to extinguish the fire.

Three elements are necessary for a fire: a heat source, oxygen, and fuel:

- The surgeon is usually in control of the heat source (eg, electrosurgical unit) and can remove it from the field.
- Anesthesia personnel are usually in control of the oxygen source and can turn it off.
- The circulating nurse and scrub technician can help ensure that alcohol-containing skin-prep solutions are meticulously applied; the skin is dry before applying surgical towels and drapes; moist sponges, towels, and aqueous solutions are available; and exposed ends of fiberoptic light cords are kept off the field.

The end of the fiberoptic light cord is as dangerous as a lit cigar on the surgical field, with temperatures reaching 670°F, Bruley notes.

If a fire occurs, the surgeon and other team members can remove burning materials and extinguish the fire with water or saline, their hands, or a wet sponge or towel. Ideally, a wet sponge or towel is always available for an emergency.

Anesthesia personnel should minimize the availability of oxygen. Burning materials that have been removed can then be extinguished by other team members, if needed, with water, saline, or—in extreme cases—with a fire extinguisher.

Of the 70 OR fire reports the Pennsylvania Patient Safety Authority analyzed, 23 named ways in which fires were extinguished.

These included:

- removing a surgical drape and dousing it with saline
- moving a surgical sponge to a basin of saline

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**Fire Prevention Algorithm**

Is patient at risk for surgical fire? (Procedures involving the head, neck and upper chest/above T5 and use of an ignition source in proximity to an oxidizer.)

Proceed but reassess for changes in fire risk frequently.

Nurses and surgeons avoid pooling of alcohol based skin preparations and allow adequate drying time. Communication between surgeon and anesthesia professional prior to initial use of electrocautery.

Does patient require oxygen supplementation? Room air sedation.

Is >30% oxygen concentration required to maintain oxygen saturation?

- No
- Secure airway with endotracheal tube or supraglottic device.
- Proceed but reassess for changes in fire risk frequently.

Use delivery device such as blender or common gas outlet to maintain oxygen below 30%.

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*Although securing the airway is preferred, for cases where using a device is undesirable or not feasible, oxygen accumulation may be minimized by air insufflation over the face and open draping to provide wide exposure of the surgical site to the atmosphere.

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• removing, disconnecting, or turning off the light cord when it was the ignition source
• dousing the fire with saline or water
• extinguishing the fire with towels (1 noted the towels were wet)
• putting out a bone cement fire with the hand
• extinguishing a fire caused by the electrosurgical unit entering the trachea with use of the surgeon’s hand, dousing the site with saline, and discontinuing supplemental oxygen.

Risk assessment
The Pennsylvania Patient Safety Authority recommends a simple fire risk assessment score, such as the one Christiana Care Health System, Wilmington, Delaware, developed to identify procedures likely to pose an increased risk for surgical fires. A score showing the following 3 elements are present indicates high risk:
• surgery above the xiphoid
• open oxygen source
• available ignition source (eg, electrocautery, unit, laser, fiberoptic light cord).

A score of 3 indicates high risk; 2 indicates low risk, with potential for conversion to high risk; 1 indicates low risk.

The score can be included in the World Health Organization’s Surgical Safety Checklist preoperative briefing or the Universal Protocol time-out.

OR teams need to have a standardized plan and discussion, notes Dr Domino. “You can have fire risk on your checklist, but if the team doesn’t communicate that the surgeon will announce to the anesthesiologist when he is going to use the electrocautery, the anesthesiologist won’t know and will leave the oxygen running,” she says.

Continuing education and communication along with fire prevention protocols are key to reducing OR fires. ❖

—Judith M. Mathias, MA, RN

References